UNIT 16 – NUCLEAR CHEMISTRY

Do 1-4, 11, 13, 14

BALANCING NUCLEAR REACTIONS WORKSHEET

Predict the missing product or reactant in the following nuclear reactions. Determine the type of nuclear reaction (α emission, β emission, γ emission, positron emission, artificial transmutation, fission, or fusion) described.

1.) $^{42}_{19}K \rightarrow ^{0}_{-1}e + ^{42}_{20}Ca$

2.) $^{239}_{94}Pu \rightarrow ^{4}_{2}He + ^{235}_{92}U$

3.) $^{235}_{92}U \rightarrow ^{4}_{2}He + ^{231}_{90}Th$

4.) $^{1}_{1}H + ^{3}_{1}H \rightarrow ^{4}_{2}He$

5.) $^{6}_{3}Li + ^{1}_{0}n \rightarrow ^{4}_{2}He + ^{3}_{1}H$

6.) $^{27}_{13}Al + ^{4}_{2}He \rightarrow ^{30}_{15}P + ^{1}_{0}n$

7.) $^{9}_{4}Be + ^{1}_{1}H \rightarrow ^{6}_{3}Li + ^{4}_{2}He$

8.) $^{37}_{19}K \rightarrow ^{0}_{+1}e + ^{37}_{18}Ar$

9.) $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{142}_{56}Ba + ^{91}_{36}Kr + 3\,^{1}_{0}n$

10.) $^{238}_{92}U + ^{4}_{2}He \rightarrow ^{241}_{94}Pu + ^{1}_{0}n$

11.) $^{14}_{6}C \rightarrow ^{14}_{7}N + ^{0}_{-1}e$

12.) $^{187}_{75}Re + ^{2}_{1}H \rightarrow ^{188}_{75}Re + ^{1}_{1}H$

13.) $^{22}_{11}Na + ^{0}_{-1}e \rightarrow ^{22}_{10}Ne$

14.) $^{218}_{84}Po \rightarrow ^{214}_{82}Pb + ^{4}_{2}He$

15.) $^{253}_{99}Es + ^{4}_{2}He \rightarrow ^{1}_{0}n + ^{256}_{101}Md$

Type of Nuclear Reaction

1.) Beta

2.) Alpha

3.) Alpha

4.) Fusion

5.) ---

6.) ARTIFICIAL TRANS

7.) Alpha

8.) Positron

9.) FISSION

10.) ARTIFICIAL TRANS

11.) BETA

12.) ARTIFICIAL TRANS

13.) ---

14.) Alpha

15.) Art trans

HALF-LIFE PROBLEMS WORKSHEET

1.) What is the half-life of a 100.0 g sample of nitrogen-16 that decays to 12.5 grams in 21.6 seconds?

100/2 = 50/2 = 25/2 = 12.5   3 √21.6 = 7.2 s

1 2 3

2.) All isotopes of technetium are radioactive, but they have widely varying half-lives. If an 800.0 gram sample of technetium-99 decays to 100.0 g of technetium-99 in 639,000 years, what is its half-life?

100/800 = 1/8 = 3 HALF LIVES   3 √639,000 = 213,000 yrs

3.) A 208 g sample of sodium-24 decays to 13.0 g of sodium-24 within 60.0 hours. What is the half-life of this radioactive isotope?

13.0/208 = 1/16 = 4 H.L.   4 √60.0 = 15. hrs

4.) If the half-life of iodine-131 is 8.10 days, how long will it take a 50.00 g sample to decay to 6.25 g?

50/2 = 25/2 = 12.5/2 = 6.25   8.10 days × 3 = 24.3 days

1 2 3

5.) The half-life of hafnium-156 is 0.025 seconds. How long will it take a 560 g sample to decay to one-fourth of its original mass?

1/4 ⇒ 2 H.L.   0.025 × 2 = 0.05 s

6.) Chromium-48 has a short half-life of 21.6 hours. How long will it take 360.00 g of chromium-48 to decay to 11.25 g?

360/2 = 180/2 = 90/2 = 45/2 = 22.5/2 = 11.25   21.6 × 5 = 108 HRS

1 2 3 4 5

7.) Potassium-42 has a half-life of 12.4 hours. How much of an 848 g sample of potassium-42 will be left after 62.0 hours?

12.4 √62 = 5 $2^5 = 32$ 32 √848 = 26.5 g

8.) Carbon-14 has a half-life of 5730 years. How much of a 144 g sample of carbon-14 will remain after 1.719×10^4 years?

5730 √17190 = 3   144/2 = 72/2 = 36/2 = 18 g   OR 8 √144

1 2

9.) If the half-life of uranium-235 is 7.04×10^8 years and 12.5 g of uranium-235 remain after 2.82×10^9 years, how much of the radioactive isotope was in the original sample?

7.04×10^8 √2.82×10^9 = 4   1 56

12.5 × 16 = 200 g